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DOCUMENT INFORMATION

Sheet 1 of 1

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Notice

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History Sheet

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Contents

Notice.....	ii
History Sheet	iii
Acronyms and Abbreviations	v
Glossary	vi
1 Introduction	1
2 Applicable Documents.....	1
3 Description	2
3.1 High-Level Waste Feed Receipt Vessel, HLP-VSL-00022.....	2
3.2 High-Level Waste Lag Storage Vessel, HLP-VSL-00027A	4
3.3 High-Level Waste Lag Storage Vessel, HLP-VSL-00027B	5
3.4 High-Level Waste Feed Blending Vessel, HLP-VSL-00028	6

Figures

Figure 1	Level Measurement for HLW feed receipt vessel (HLP-VSL-00022)	8
Figure 2	Level Measurement for HLW lag storage vessel (HLP-VSL-00027A).....	9
Figure 3	Level Measurement for HLW lag storage and feed blending vessel (HLP-VSL-00027B).....	10
Figure 4	Level Measurement for HLW feed blending vessel (HLP-VSL-00028)	11

Acronyms and Abbreviations

Reference the piping and instrumentation diagrams (P&IDs) symbols and legend sheets as listed in the Applicable Documents section, for acronyms and abbreviations used in Figures 1 through 4.

DOE	US Department of Energy
FEP	waste feed evaporation process
HLP	HLW lag storage and feed blending process
HLW	high-level waste
LOL	lower operating limit
P&ID	piping and instrumentation diagram
PT	pretreatment
PCS	process control system
Sr/TRU	strontium and transuranic elements
TFC	tank farm contractor
UFP	ultrafiltration process
UOL	upper operating limit
WTP	River Protection Project - Waste Treatment Plant

Glossary

acquire	Acquire is a command under a batch control that reserves a group of equipment for that particular batch control operation.
actual volume	Actual volume is the amount, in US gallons, of waste or process fluid in any vessel.
available space	Available space refers to the volume, in US gallons, of waste or process fluid that any vessel can accommodate and remain below the upper operating limit (UOL). Available space can be calculated as follows: $Available\ Space = UOL - Actual\ Volume$
available volume	Available volume refers to the volume, in US gallons, of waste or process fluid that any vessel can transfer to another vessel and remain above the lower operating limit (LOL). Available volume can be calculated as follows: $Available\ Volume = Actual\ Volume - LOL$
batch	This refers to material that is being produced or that has been produced by a single execution of a batch process.
batch control	This term refers to control activities and control functions that provide an ordered set of processing activities to complete a batch process.
batch process	A batch process leads to the production of a finite quantity of material by subjecting quantities of input material to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.
control system	This term refers to electronic processors that perform regulatory and logic control functions necessary for normal operation of the plant.
exception handling	This term refers to those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
intermediate products	These are treated high-level waste (HLW) products that are staged and blended in the pretreatment (PT) facility prior to immobilization in the HLW vitrification facility. These products include treated solids slurry, strontium and transuranic elements (Sr/TRU) precipitate slurry and cesium concentrate.
LOL	Lower operating limit- a vessel low level set point used to stop a transfer-out batch operation from that vessel under normal plant operations.
permissive	A permissive is an interlock that allows a device to change state or a sequence to start. Once a device has changed state or a sequence has started, a permissive has no further effect on the device or sequence.
release	Release is a command under a batch control that opens up a group of equipment for any batch control to acquire.
requested volume	The requested volume is the volume, in US gallons, of waste or process fluid that can be delivered to the destination vessel and the total volume will remain below the vessel's upper operating level.

Sr/TRU precipitate	For envelope C feed, the strontium and transuranic elements are precipitated out of solution and separated from the supernate along with any entrained solids to produce the slurry.
trip	A trip is an interlock that does not allow a device to change state or a sequence to start. Once a device has changed state or a sequence has started, a trip continues to have an effect on the device or sequence.
UOL	Upper operating limit – A vessel high level setpoint used to stop a transfer-in batch operation to that vessel under normal plant operation.

1 Introduction

This document describes the control logic associated with vessel instrumentation and other ancillary equipment, such as pumps and valves, within the HLW lag storage and feed blending process (HLP) system in the pretreatment (PT) facility that function to prevent inadvertent overflows within this system through the control system.

2 Applicable Documents

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6.*

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6.*

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6.*

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6.*

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6.*

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6.*

24590-PTF-M6-HLP-P0001, *P&ID-PTF HLW Lag Storage and Blending Process Vessel HLP-VSL-00027A/B (Q).*

24590-PTF-M6-HLP-P0002, *P&ID-PTF HLW Feed Receipt Vessel HLP-VSL-00022 (Q).*

24590-PTF-M6-HLP-P0003, *P&ID-PTF HLW Feed Blending Process Vessel HLP-VSL-00028 (Q).*

24590-PTF-M6-HLP-P0005, *P&ID-PTF HLW Lag Storage and Feed Blending Utility Services -PSA Rack (Q).*

24590-PTF-M6-HLP-P0006, *P&ID-PTF HLW Lag Storage and Feed Blending Utility Services -PSA Rack (Q).*

24590-PTF-M6-HLP-P0007, *P&ID-PTF HLW Lag Storage and Feed Blending Utility Services -PSA Rack (Q).*

24590-PTF-M6-HLP-P0009, *P&ID-PTF HLW Lag Storage and Blending Utility Services Plant Wash Rack (Q).*

24590-PTF-M6-HLP-P0010, *P&ID-PTF HLW Lag Storage and Blending Utility Services – Plant Wash Rack (Q).*

24590-PTF-3YD-HLP-00001, *System Description for HLW Lag Storage and Feed Blending Process System (HLP).*

3 Description

The following sections describe the 4 major vessels that make up the HLP system and the associated instrumentation.

3.1 High-Level Waste Feed Receipt Vessel, HLP-VSL-00022

During normal operations, the HLW feed receipt vessel (HLP-VSL-00022) receives feed from the US Department of Energy (DOE) tank farm. There it is staged, sampled, and then transferred to the ultrafiltration process (UFP) system, the waste feed evaporation process (FEP) system, or the waste feed receipt process (FRP) system for further processing. There is also the capability to return the feed back to DOE tank farm when required; however, this is considered a rare event.

Prior to and during the transfer of feed from the tank farm to HLW feed receipt vessel (HLP-VSL-00022), there is manual data exchange between the River Protection Project - Waste Treatment Plant (WTP) contractor and the tank farm contractor (TFC) to ensure a safe transfer operation and to prevent vessel overflow. This data interface is regulated through administrative controls and hardwired permissive signal exchanges.

Administrative controls take place over the telephone between the WTP contractor and the TFC and are part of the pre-start, and transfer - and post-transfer checks. These controls are as mentioned in ICD 20-Interface Control Document for High -Level Waste Feed.

The pre-start controls are listed as follows and are confirmed prior to commencing the transfer:

Pre-Start Controls	Purpose
Confirm 1 of the 3 transfer lines are selected.	This will allow for proper valve alignment, thereby preventing misrouting of feed to WTP.
Calculate available space in HLW feed receipt vessel (HLP-VSL-00022) and request feed transfer volume based on the available space, in US gallons.	This will prevent overflow and will be used for feed transfer balance calculations.
Confirm space is available in the HLW effluent transfer vessel (PWD-VSL-00043) to receive transfer line post flush drain.	This will prevent solids from settling inside the transfer lines after transfer and will prevent overflow in HLW effluent transfer (PWD-VSL-00043).
Confirm that the level transmitter, temperature transmitter, control valves, flow meters, and other associated instrumentation are functional.	This will ensure that the transfer can be monitored and controlled.
Confirm that the high alarm in black cell or hot cell sumps is not activated.	This will monitor unjacketed transfer lines within PT facility for leaks and avoid overflow of ultimate overflow vessel (PWD-VSL-00033).

The following are the transfer controls that take place once transfer of feed has actually started:

Transfer Controls	Purpose
Confirm receipt (through level change) of pre-transfer warming flush.	This will avoid crystallization of solids in the line and also ensure that the valves are aligned

Confirm receipt of feed from level instrumentation in the vessel and from flow indication.	properly. This ensures safe transfer control operation.
Notify TFC to stop transfer when the target volume in receipt tanks is achieved and to begin post-transfer flush drain.	This will prevent overflow of HLW feed receipt vessel (HLP-VSL-00022) and ensure no feed remains in the lines.

The following are the post-transfer controls that take place once transfer of feed has been completed:

Post-Transfer Controls	Purpose
Return all equipment to pre-transfer condition.	This will ensure that the valves are in proper position after transfer.
Calculate volume of flush and actual feed received from the TFC.	This value is used for feed transfer balance calculations.

The following signals are used to generate a single hardwired permissive or trip signal that is transferred to the TFC using signal cables originating at the WTP control system and terminating at the TFC control system. This permissive or trip signal is directly tied to the TFC master pump logic, to allow either a pump to start (permissive) or to stop (trip) a running pump.

Permissive/Trip Signal	Purpose
High-High level alarm in ultimate overflow vessel (PWD-VSL-00033).	This condition will be used as a trip to stop the transfer pump, hence prevent an overflow of ultimate overflow vessel (PWD-VSL-00033); however, there will be a monitored supervisory override to flush lines if needed.
High level alarm in HLW effluent transfer vessel (PWD-VSL-00043).	This condition will be used as a trip to stop the transfer pump to ensure available volume for drain flush after transfer.
All valves are properly aligned in WTP PT facility for transfer from TFC.	This condition will be used as a permissive to allow transfer from TFC to WTP to start, to avoid deadheading of the transfer pump, and to prevent overflow due to a misroute.
High alarm in transfer line leak pot.	This condition is used as a trip to stop the transfer pump, hence avoid environmental contamination and prevent overflow of ultimate overflow vessel (PWD-VSL-00033); however, there will be a monitored supervisory override to flush lines if needed.
Operator enable-disable transfer.	This command will be used as a permissive or trip to allow TFC to start or to stop the pump.
High level alarm in HLW feed receipt vessel (HLP-VSL-00022).	This condition will be used as a trip to stop the transfer pump, hence prevent an overflow of HLW feed receipt vessel (HLP-VSL-00022).

When vessel HLW feed receipt vessel (HLP-VSL-00022) is ready to receive feed from the TFC, the WTP operator will initiate the transfer-in batch control operation. This operation will prompt the WTP operator to enter the transfer volume and the line selected into the control system as parameters for that operation. Once

the parameters are entered by the operator, the batch control will automatically align the valves. The control system will also verify that all instruments, utilities and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. The position feedback switches for these valves are also continually monitored by the batch control and if any of the valves are not in the correct position, the sequence will switch to an exception handling function that initiates pre-determined corrective action.

Each step in the batch operation will be performed automatically with built-in operator prompts as dictated by the pre-start and post-transfer administrative controls mentioned above. The transfer-in sequence will be completed when the required batch has been transferred, post-transfer flushing and draining have been completed, and the transfer volumes between WTP and TFC have been reconciled.

For better control of any transfer operation involving the HLW feed receipt vessel (HLP-VSL-00022), transfers are limited by the batch control operation to one transfer at a time. Once the batch control acquires HLW feed receipt vessel (HLP-VSL-00022), no other batch control operation will be able to acquire the vessel until it is released from the initial operation. The acquire and release commands ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

Once the vessel is filled and sample results obtained, the transfer-out sequence can be initiated. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in vessel HLW feed receipt vessel (HLP-VSL-00022) reaches its lower operating level (LOL).
- The specified volume is transferred.
- The destination vessel reaches its upper operating level (UOL).

During the entire transfer-in or transfer-out sequence, the control system continually monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The transfer can then be stopped manually at the discretion of the operator.

All of the above will help prevent an overflow condition in vessel HLW feed receipt vessel (HLP-VSL-00022).

As mentioned earlier, there is the capability to return feed from vessel HLW feed receipt vessel (HLP-VSL-00022) back to the DOE tank farm. This transfer is also controlled by a transfer-out batch control operation with built-in pre-start and post-transfer administrative controls and hard-wired data exchanges between the WTP contractor and the TFC. These controls are as mentioned in ICD 20-Interface Control Document for High-Level Waste Feed.

Refer to Figure 1 for level measurement details for the HLW feed receipt vessel (HLP-VSL-00022).

3.2 High-Level Waste Lag Storage Vessel, HLP-VSL-00027A

The HLW lag storage vessel (HLP-VSL-00027A) receives intermediate waste products, such as Sr/TRU precipitate and treated solids from the UFP system, and transfers them to the feed blending vessel (HLP-VSL-00028). There is also the option to transfer to the HLW lag storage vessel (HLP-VSL-00027B). For better control of any transfer operation involving the HLW lag storage vessel (HLP-VSL-00027A), transfers are limited by the batch control operation to one transfer in or out at a time. Once the batch control acquires HLW lag storage vessel (HLP-VSL-00027A), no other batch control operation can acquire the vessel until it has been released from the initial operation. The acquire and release commands ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

When the vessel is available to receive feed, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in HLW lag storage vessel (HLP-VSL-00027A) reaches its UOL.
- A specified volume is transferred.
- The source vessel reaches its LOL.

When the level in HLW lag storage vessel (HLP-VSL-00027A) reaches its UOL, the control system will notify the operator through the Plant Control System Interface that HLW lag storage vessel (HLP-VSL-00027A) is ready for sampling and transferring out. Once the transfer-out sequence is initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in vessel HLW lag storage (HLP-VSL-00027A) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system continually monitors the sump alarms within PT facility and notifies the operator if an alarm condition occurs. The transfer can then be stopped manually at the discretion of the operator. The position switches of the valves are also constantly monitored by the control system. If any of the associated valves are not in the correct position, the batch control will switch to an exception handling logic.

Refer to Figure 2 for level measurement details for the HLW lag storage vessel (HLP-VSL-00027A).

3.3 High-Level Waste Lag Storage Vessel, HLP-VSL-00027B

The HLW lag storage vessel(HLP-VSL-00027B), receives intermediate products, such as Sr/TRU precipitate and treated solids from the UFP system, and transfers them to the feed blend vessel (HLP-VSL-00028). It can also be used as a back-up blend vessel, hence has the ability to receive Cs concentrate from the cesium nitric acid recovery process system. For better control of any transfer operation involving the HLW lag storage vessel (HLP-VSL-00027B), transfers are limited by the batch control operation to one transfer in or out at a time. Once the batch control acquires vessel HLP-VSL-00027B, no other batch control operation is able to acquire the vessel until it is released. The acquire and release commands ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

When the vessel is available to receive feed, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in HLW lag storage vessel (HLP-VSL-00027B) reaches its UOL.
- A specified volume is transferred.

- The source vessel reaches its LOL.

When the level in HLW lag storage vessel (HLP-VSL-00027B) reaches the UOL, the control system will notify the operator through the Plant Control System Interface that HLW lag storage vessel (HLP-VSL-00027B) is ready for sampling and transferring out. Once the transfer-out sequence is initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in HLW lag storage vessel (HLP-VSL-00027B) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system continually monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The transfer can then be stopped manually at the discretion of the operator. The position switches of valves are also constantly monitored by the control system. If any of the associated valves are in the wrong position, the batch control will switch to an exception handling logic.

Refer to Figure 3 for level measurement details for HLW lag storage and feed blending vessel (HLP-VSL-00027B).

3.4 High-Level Waste Feed Blending Vessel, HLP-VSL-00028

The HLW feed blending vessel (HLP-VSL-00028) receives treated solids and Sr/TRU precipitate from HLW lag storage vessel (HLP-VSL-00027A) or HLW lag storage vessel (HLP-VSL-00027B). It can also receive treated solids and Sr/TRU precipitate directly from the UFP system. It also receives cesium concentrate from the cesium nitric acid recovery process system and concentrated washed solids from the FEP system. After the blending operation, the blended product is transferred to the HLW vitrification facility into vessel HLW concentrate receipt vessel (HCP-VSL-00001) or HLW concentrate receipt vessel (HCP-VSL-00002). The HLW feed blending vessel can also be used as a lag storage vessel. For better control of the transfer operation involving the HLW feed blending vessel (HLP-VSL-00028), transfers are limited by the batch control operation to one transfer in or out at a time. Once the batch control acquires vessel HLW feed blending vessel (HLP-VSL-00028), no other batch control operation can acquire the vessel until it is released. The acquire and release commands ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

When the vessel is available to receive feed, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in HLW feed blending vessel (HLP-VSL-00028) reaches its UOL.
- A specified volume is transferred.
- The source vessel reaches its LOL.

When HLW feed blending vessel (HLP-VSL-00028) reaches its UOL, the control system will notify the operator through the Plant Wide Control System Interface that HLW feed blending vessel (HLP-VSL-00028)

is ready for sampling and transferring out. Once the transfer-out sequence is initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in HLW feed blending vessel (HLP-VSL-00028) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system continually monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The level in the leak detection pots during transfer out to HLW facility is also constantly monitored for any alarm conditions. The transfer can then be stopped manually at the discretion of the operator. The position switches of valves are also constantly monitored by the control system. If any of the associated valves are in the wrong position, the batch control will switch to an exception handling logic.

Refer to Figure 4 for level measurement details for HLW feed blending vessel (HLP-VSL-00028).

Figure 1 Level Measurement for HLW feed receipt vessel (HLP-VSL-00022)

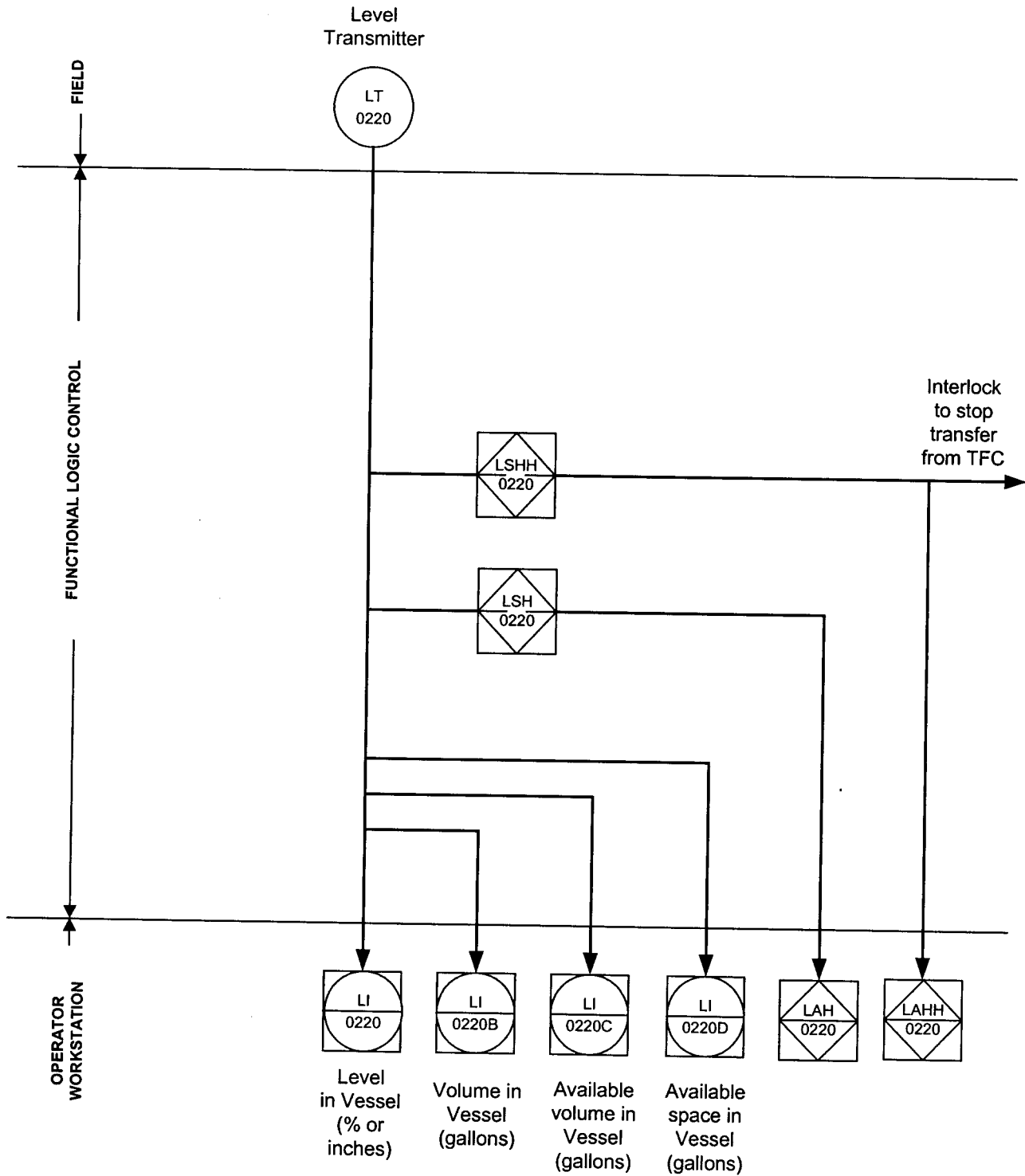


Figure 2 Level Measurement for HLW lag storage vessel (HLP-VSL-00027A)

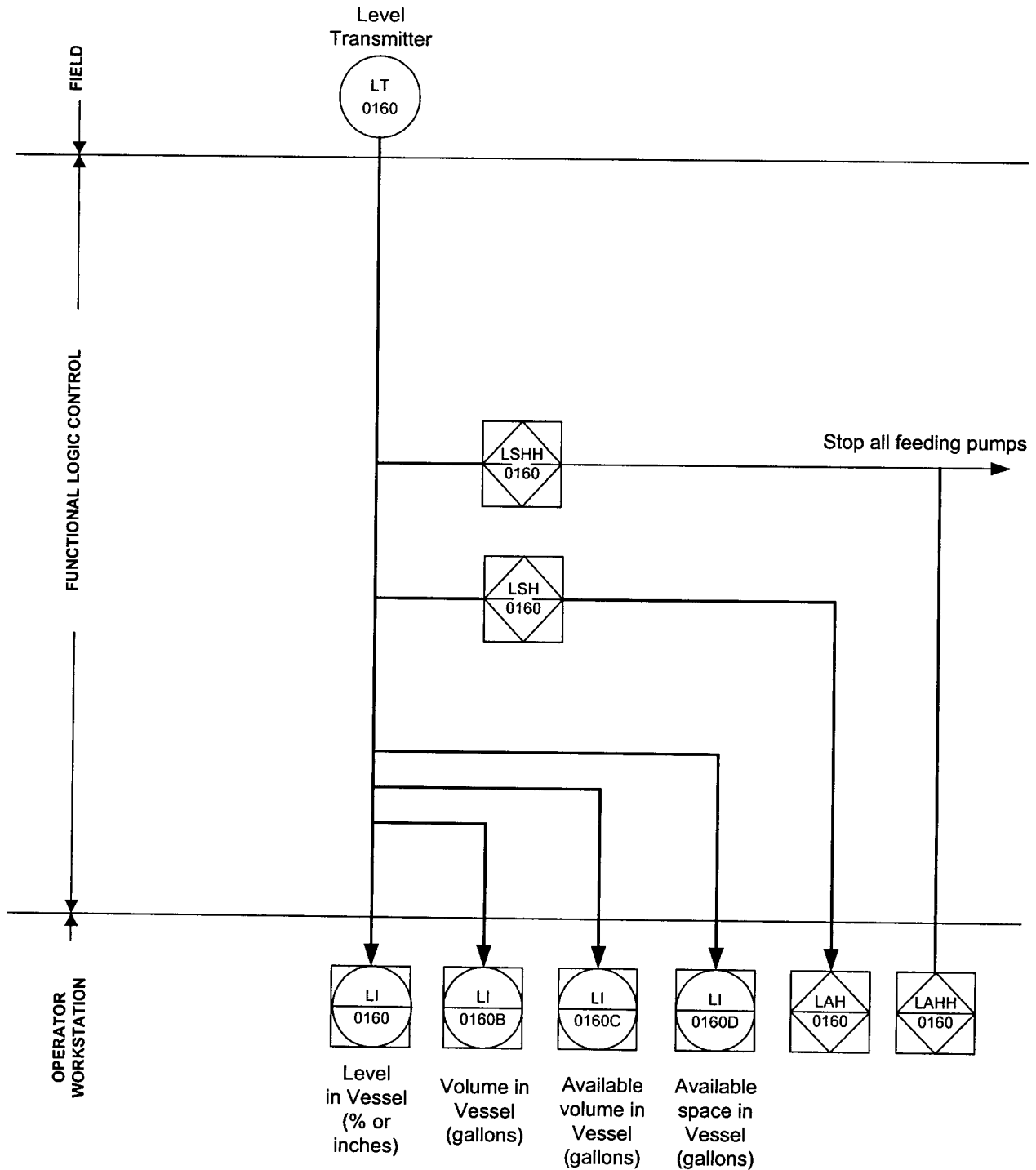


Figure 3 Level Measurement for HLW lag storage and feed blending vessel (HLP-VSL-00027B)

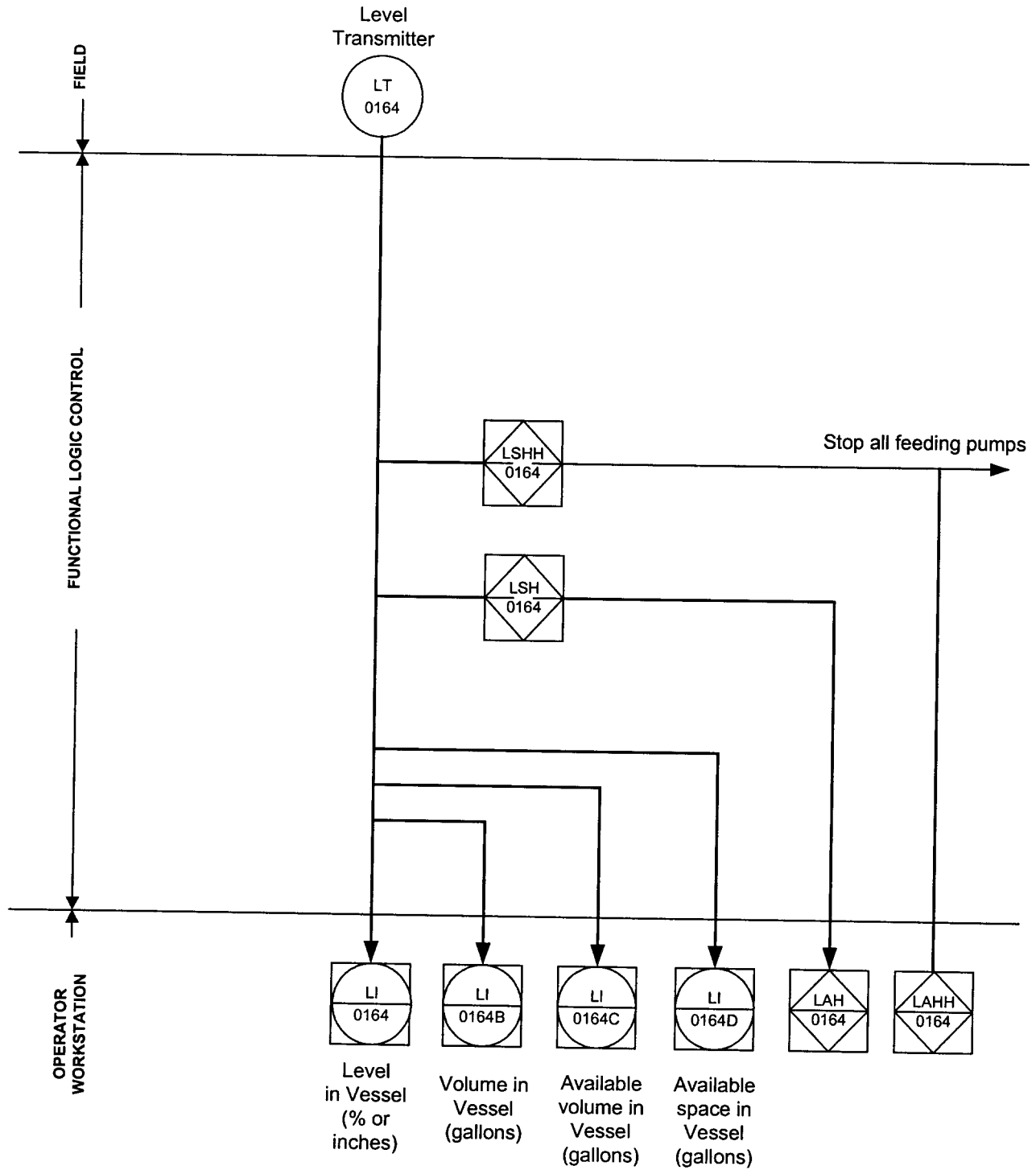


Figure 4 Level Measurement for HLW feed blending vessel (HLP-VSL-00028)

